JOINT VENTURE HSV-X1
SNAP SHOT
20 MAR 02 – 13 JUL 02

Introduction

In January 2001, the Army approved the Operational Requirements Document (ORD) for the Theater Logistic Vessel (TLV). This ORD was the first major step in Army Watercraft Transformation. In conjunction with The Army Transformation, the TSV will give the warfighting combatant commander Intratheater Operational Maneuver and Sustainment of combat effective unit sets, delivering soldiers and their equipment, as cohesive fighting units. With the ability to bypass theater choke points and gain access to austere and degraded ports, the TSV will add a new dimension to theater support and sustainment.

To accomplish this, the TSV must be of shallow draft (less than 15 feet), high speed (excess of 35 knots) and carry sufficient cargo (up to 1250 tons) to support the Army of Transformation.

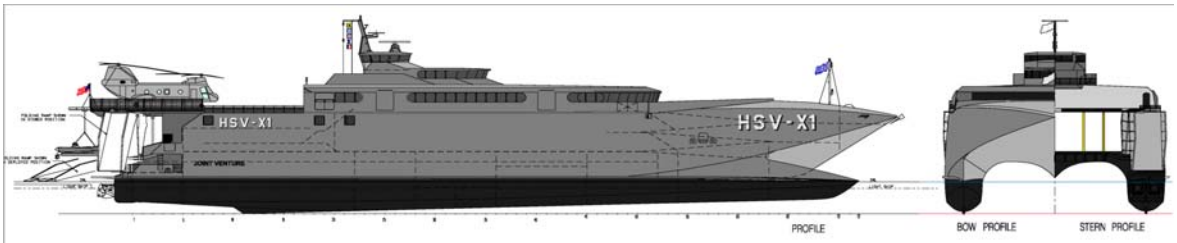
To support this effort, the Army has proceeded to seek a demonstration vessel using Research and Development funding, to validate and demonstrate the capabilities of high speed intra-theater sealift. In October 2001, the U.S. Army Tank Automotive and Armament Command (TACOM) chartered, through Bollinger/Incat USA, The Joint Venture (HSV-X1). This vessel is a Joint Demonstration platform that will be utilized by the U.S. Army and the U.S. Navy for a period of up to 2 years.

During the Army's Administrative Control of the vessel (20 March 2002 – 12 July 2002) the vessel has transited the Straits of Gibraltar, the Mediterranean Sea, The Suez Canal, Red Sea, Persian Gulf, Indian Ocean and the Pacific Ocean with a final destination of San Diego, California. A total of 7 countries, 1 British Territory, 1 US Territory and 1 US state have been visited, accumulating in excess of 27,500 nautical miles traveled.

While in the Persian Gulf, the HSV participated in several cargo movements totaling 1691 tons, 336 pieces of cargo and 123 passengers.

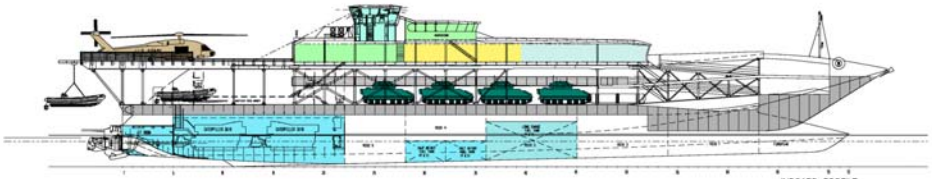
Specifications:

The Joint Venture (HSV-X1) is a 96 meter Wave Piercing Catamaran (WPC) built by Incat Tasmania Pty Ltd. The Joint Venture (Incat Hull #50) was constructed in November 1998 and placed into service as a Passenger/Car Ferry. Upon signing of the charter, the vessel underwent six weeks of technical and structural modifications. These modifications included, a two part hydraulically operated stern quartering ramp to facilitate loading and unloading of rolling and breakbulk cargo; a helo-deck capable of day time operations in the landing of SH-60 Seahawk and CH-46 Sea Knight helicopters, crew berthing and limited passenger berthing. (See figure one)

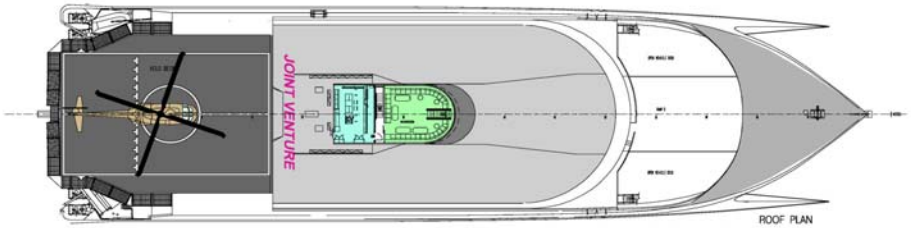


PROFILE

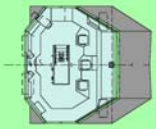
BOW PROFILE STERN PROFILE



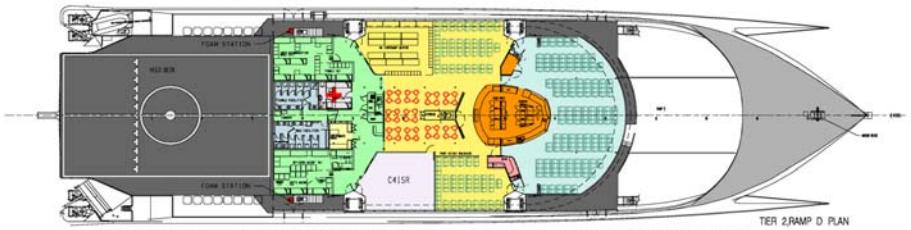
INBOARD PROFILE



ROOF PLAN

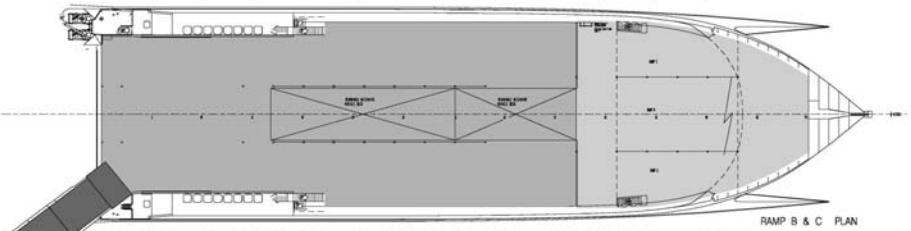


WHEELHOUSE PLAN
SCALE 1:100



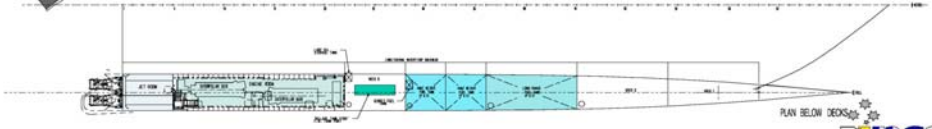
TIER 2,RAMP D PLAN

JOINT VENTURE



RAMP B & C PLAN

TIER 1 & RAMP A PLAN



PLAN BELOW DECKS

JF 96

LENGTH OVERALL	95.47M
LENGTH WATERLINE	86.25M
BEAM OVERALL	26.00M
DRAFT @ 1700t	4.00M

		96M WAVE PIERCING CATAMARAN U.S. JOINT FORCES HSV PRELIMINARY GENERAL ARRANGEMENT
050-09-92-001-MAR	REV. T 30 AUG '01	SCALE (A0) 1:200, (A1) 1:250, (A3) 1:500
DATE: 08 JAN '98		DRAWN BY: G.L.D./G.S.

Figure 1

Length Overall:	96 meters (313’ 0”)
Beam:	26.60 meters (87’ 4”)
Draft:	3.67 meters (12’ 0”)
Deadweight:	740 tonnes (815 short tons)
Speed:	approx. 38 knots (operational)
	approx. 42 knots (lightship)

All speeds at 100% Maximum Continuous Rating (MCR) (38,620 HP)

Range: Delivery Speed

Design:

Two slender, aluminum hulls connected by a bridging section with center bow structure at the forward end. Each hull is divided into nine vented, watertight compartments.

Construction:

Welded aluminum construction using predominantly aluminum grade of 5383 H321 or H116 and extrusion grade 6082 and 5083.

Machinery:

Main Engines:	4 x Caterpillar 3618 marine diesel engines rated at 9,655 hp at 100% MCR.
Water Jets:	4 x Lips 150D configured for steering and reverse.
Transmission:	4 x Reintjes gearboxes
Ride Control:	“Maritime Dynamics” active ride control. Combination of active trim tabs aft and T-foils located forward on each hull.
Generators:	4 x Caterpillar 3406 230 KW, 415/240 VAC, 50 Hz

Capacities:

Crew Accommodations:	45 personnel
Transient Berthing:	48 personnel
Seating Capacity:	280 passengers

Cargo Deck:

Main Deck:	4036 sqft at 15’ 3’’ clear height
	8078 sqft at 13’ 1” clear height
	12,114 sqft total
Mezzanine & Ramps:	10,850 sqft at 6’6” clear height
Total Deck Space:	22,964 sqft

Fuel Capacity:

Day Tanks:	46,230 gallons US
Long Range Tanks:	103,766 gallons US
Total:	149,996 gallons US

Fresh Water:

2 X storage tanks:	2 x 1,500 gallons US

Water maker: Reverse Osmosis, production 1,100 gallons US per day

Cargo Ramps:

47’ Articulating Starboard Stern Quartering Ramp:
- 73,000 lb max capacity
- 14’ 6” maximum cargo width
- 15’ maximum cargo height

39’ Portable Stern Ramp: Deployed directly astern using Gantry Crane
- 73,000 lb max capacity
- 14’ maximum cargo width
- 13.5’ maximum cargo height

Gantry Crane:

Stern Center Line mounted
- Maximum Lift: 10 tons
- Launch and recover up to 11M RHIB
- Launch and Recover Seal Delivery Vehicle
- Deploy and Recover Portable Stern Ramp

Helo-Deck:

Aft Stern Location
- 81’ long x 64’ wide
- Day Time Ops Only
- SH-60 Seahawk
- CH-46 Sea Knight

Self Defense:

4 ea - .50 Cal M2 Machine Gun
- 2 Mounts Forward (Port & Stbd Passenger Deck)
- 1 Mount Center Line (Helo Deck)
- 1 Mount Port Aft Mooring Station

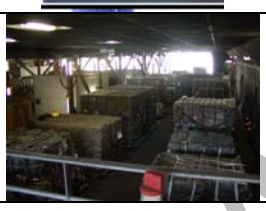
4 ea – M60 Machine Gun
- 2 Mounts Forward (Port & Stbd Passenger Deck)
- 2 Mounts Aft (Port & Stbd Helo Deck)

CARGO OPERATIONS

A total of 18 Cargo Operations were conducted while in the CENTCOM AOR. Due to the nature of the missions, dates, ports of loading and offloading, and specific pieces carried will for each load will not be identified, only total distance traveled, time, average speed, total fuel consumed, average consumption rates, cargo count and tonnage will be annotated. (See Table 1)

Types of Cargo Carried and Evaluated:

Vehicle Type	Photo	HSV Compatibility	Comments
8 Meter RHIB		Yes	All slings and trailers worked fine in load and offload situations. Prime mover for the RHIB Trailer combination while on the main deck was a 6K RTFL with Pintle hitch attached to the Forklift tines
Seal Delivery Vehicle (SDV)		Yes	Both loading with the trailer over the ramp and deployment and recovery using Gantry Crane
11 Meter (RHIB) Rigid Hull Inflatable Boat		Yes	Loading while the Rhib is on the trailer because of the overall length of the unit was confined to the after section of the cargo deck. The prime mover was a 6x6 10 ton truck with a front mounted pintle hitch which increased the maneuverability of the boat/trailer on the deck. Using the updated slings, the 11M Rhib was easily loaded onto the deck of the vessel and onto the RHIB Trailer.

Vehicle	Photo	Vessel Compatibility	Comments
M1061A1 Trailer, Flatbed		YES	
M577A2 Carrier Command M113A2 Carrier Troop M1064A3 Carrier 120MM Mortar		YES	 All Tracked Vehicles caused damage to the raised tie downs on deck during pivot turns
ATLAS 10K		YES	Most easily maneuvered around the deck in the 4 wheel steering mode
463L Pallets		YES	As with all palletized cargo, loading and unloading is very time consuming and place an additional requirement on the crew for extensive tie down times
M35A2 and MKT-85 (Kitchen, Trailer)		YES	Even without power steering, the M35A2 was able to make the turn around the horseshoe with out having to perform a three point turn. Vehicle must start at extreme outboard traffic lane to make the complete turn. If vehicle and trailer were on the inboard traffic lane while loading, the trailer had to be disconnect to allow the truck to make the three point turn without jack knifing the trailer.

Vehicle	Photo	Vessel Compatibility	Comments
M101A1 Trailer Cgo M105 Trailer Cgo		YES	Most trailers had to be disconnected from the prime mover to enable easier maneuvering during loading operations
M1025A2 M998 M1026A1		YES	All Vehicles compatible except for all high back versions of the HMMV, which could not be loaded in the horseshoe forward due to height restriction of 6'6"
M923		YES	During loading, vehicle must use outboard vehicle lanes to avoid 3-point turn.
M936 Wrecker		YES	During loading, vehicle must use outboard vehicle lanes to avoid 3-point turn
M149A2 Water Trailer		YES	Most trailers had to be disconnected from the prime mover to enable easier maneuvering during loading operations
Stryker		YES	All Strykers were able to complete the turn radius at the forward part of the Main Deck

HSV-X1 Portable Stern Ramp
73,000 LB Capacity
(Gantry Crane Deployed)

HSV-X1 Stern Quartering Ramp
(73,000 LB Capacity)

CARGO DECKS

Main Deck
4036 sqft at 15’ 3’’ clear height
(Outboard Traffic Lanes and Stern Area)
8078 sqft at 13’ 1” clear height (under Mezzanine Deck)
12,114 sqft total

PORT SIDE LOOKING FORWARD

CENTERLINE LOOKING FORWARD

STARBOARD SIDE LOOKING FORWARD

Ramps and Mezzanine Decks
10,850 sqft at 6’6” clear height

PORT SIDE RAMP LOOKING FORWARD

“HORSESHOE” TOP OF PORT AND STARBOARD RAMPS

STARBOARD SIDE RAMP LOOKING FORWARD

RAMP LEADING FROM "HORSESHOE" TO MEZZANINE DECK AND UPPER RAMPS

MEZZANINE DECK IN STORED POSITION

Synopsis of Cargo Missions Performed in the CENTCOM AOR
Table 1

DIST	HRS	SPD	FUEL(Liters)	Fuel (gallons)	Burn Rate (Ltr/nm) (average)	Burn Rate (gal/nm) (average)	PCS	STONS	PAX
247	8	32	44,782.00	11,831.44	181.30	47.90	0	0	3
494	15	32	96,224.00	25,422.46	194.79	51.46	12	51.9	16
120	8.7	18	18,890.00	4,990.75	157.42	41.59	12	51.9	16
347.2	11	31.5	59,360.00	15,682.96	170.97	45.17	24	106.7	10
172.8	5	32	33,176.00	8,765.13	191.99	50.72	16	14.6	9
245	7.3	33.6	43,650.00	11,532.36	178.16	47.07	10	46.2	3
70	7	10	12,900.00	3,408.19	184.29	48.69	10	49	14
494	15	32.9	36,239.00	9,574.37	73.36	19.38	0	0	1
247	7.3	33.6	47,023.00	12,423.51	190.38	50.30	8	23.7	18
247	7.3	33.6	55,444.00	14,648.35	224.47	59.31	9	28.8	7
694.4	21	33	118,904.00	31,414.53	171.23	45.24	37	205.4	0
694.4	21	33	119,104.00	31,467.37	171.52	45.32	36	205.9	0
782	35	30	97,950.00	25,878.47	125.26	33.09	32	278.9	0
716	21	31	122,877.00	32,464.20	171.62	45.34	37	247.6	1
782	22.6	31	135,555.00	35,813.74	173.34	45.80	22	240.9	3
43.2	2	35	9,949.00	2,628.53	230.30	60.85	0	0	7
368.8	11	35	58,037.00	15,333.42	157.37	41.58	17	20.34	0
1871	78	26.5	273,583.00	72,280.85	146.22	38.63	54	119.07	0

The deployment of the vessel to the CENTCOM AOR provided the user a unique opportunity to experience a wide range of ports and cargo. All ports visited were considered well developed, world class ports, meaning all piers/marshalling areas were concrete. Fendering systems were found to be more than adequate and port infrastructures were more than capable of facilitating the HSV-X1.

Loading:

All cargo loads were coordinated between the user and the vessel. This facilitated a more effective means of communications in explaining the vessel capabilities. To develop a load plan, a simple cargo list was sent to the vessel that included: Quantity, Model, Description, Dimensions, and Weight for each piece of equipment. The First Mate would develop the load plan using ICODES and respond back to the using unit for load verification. For the most part, Military Traffic Management Command (MTMC) was the primary agent. All load plans were developed using ICODES. Although ICODES was used, in the first few loads carried, the using unit did not have accurate weights of equipment being loaded. This was due to not accounting for "secondary loads" the vehicles were carrying. This unaccounted weight caused difficulty in getting the vessel in the proper trim. The result was re-stowing cargo on deck after it was loaded, usually moving it further aft on deck.

ICODES is a vessel loading management program that aids the vessel operator and loading units in preparing load plans. In the ICODES database, there is a listing almost all military equipment. This database includes equipment weight, axle loads, and dimensions. The vessel is also in the database. The information on the vessel includes deck plan layout, ramp dimensions and any height, width or weight restrictions the vessel might have that would limit its loading capabilities. During this deployment, it was discovered that ICODES for the HSV has some discrepancies. The discrepancies noted were that ICODES did not take into account the "organic" equipment that was on the vessel: ship's vehicle, 6K forklift, 2 ea 30 KW generators, Incat parts trailer, Caterpillar Part Container and the Portable Ramp. Because this equipment was not documented in the ICODES data base as being organic to the vessel, outside agencies using ICODES would create load plans and make the assumption that all of the cargo would fit. Upon arrival at the port, the vessel load plan and the agencies load plan did not match. This problem was addressed to the contractor that produces ICODES for the military. To alleviate any future confusion, the vessel requested the loading agency to send a list of equipment and the vessel would produce the load plan and send it back to the agency prior to the vessel's arrival in port.

During loading operations, in all but one case, all cargo was received using the stern quartering ramp. This was due to pier availability and pier construction. This also allowed to vessel to moor along side the pier providing a very stable platform. In all cases, the pier had no obstructions that hindered the vessel from placing the foot of the Quartering Ramp solidly on the pier.

All cargo loading, except in one case, was performed by U.S. Army soldiers or Navy sailors. The one exception was during break bulk cargo loading. MTMC contracted for MHE and drivers because the vessel had no organic capability to handle the size of cargo being loaded. Predominantly, when handling US Navy cargo, the loading unit provided the necessary operators for their equipment. In all Army cargo uploads, Army soldiers were the operators of the equipment. None of the Army operators were MOS 88H, cargo specialists. Due to the unfamiliarity with the equipment and lack of experience in ship loading, an increase in load times was experienced. It was, however, a good indicator of what a vessel might encounter during actual deployments where unit moves are involved.

The crew accomplished the securing of cargo, after loading was completed. All cargo that was loaded in the horseshoe and on the ramps in the forward part of the vessel were secured with 4 tie downs, two on the front and two on the rear.

Cargo on the Main Deck was tied down according to sea state and weather anticipation. For the most part, the first and last piece of cargo in each row was secured to the deck. All light equipment was lashed down using 5,000 lb nylon web ratchet straps. All heavy equipment was lashed down using the 7,500 lb chains. Break bulk cargo was secured using 5,000 lb nylon web ratchet straps.

Careful placement of the load on the deck was required so the maximum amount of tie down points on the deck could be available. Because the vessel was originally a passenger car ferry, the existing tie down points did not have the appropriate spacing for the usually wider military cargo carried.

The moveable Mezzanine deck was not used. Some of the vessel's organic equipment, i.e. Incat trailer, Caterpillar container and forklift were stored underneath this deck. The height of this equipment did not allow the deck to be lowered to its working height. It was also not used due to the load limit of the deck did not allow for any rolling stock to be loaded. Recommendation is that future vessels should consider not incorporating this deck into their final construction configuration.

Average cargo load time: 50 minutes
Fastest cargo load time: 33 minutes
Average offload time: 34 minutes
Fastest offload time: 20 minutes
Average Piece count per cargo load: 33 pieces
Highest Cargo Count: 54 pieces
Lowest Cargo Count: 17 pieces

The amount of crew involved during loading operations remained fairly constant regardless of what type of cargo was being loaded. The duties and placement on deck are as follows:

Position	Duties	Location on Deck
First Mate/Cargo Officer (CW3)	Vessel interface between Loading agency (MTMC), port services (MHE) and loading unit crew/drivers. Checking cargo as it was being loaded. Verifies type, size, weight and location on deck.	Base of Ramp
Cargo NCO/Bos'n (88K30)	In charge of deck personnel during loading operations. Coordinates with First Mate on cargo location on deck.	Main Deck
Asst Cargo NCO (88K20)	Staging cargo at base of ramp. Sets order of equipment to be loaded. Briefs drivers on loading procedures	Base of Ramp
Asst Cargo NCO (88K20)	Operates Ramp. Ensures proper clearance between ramp and pier is maintained. Determines Ramp setup. Monitors ramp cables, angle of ramp, mooring lines and tides	Aft Section of Main Deck
Ground Guide/Deck Hand (88K10)	Aligns cargo at base of ramp for proper transit over ramp. Secures Cargo for transit after loading is complete	Base of Ramp
Ground Guide/Deck Hand (88K10)	Aligns cargo at top of ramp for proper transit over ramp. Secures Cargo for transit after loading is complete	Top of Ramp
Ground Guide/Deck Hand (88K10)	Directs Cargo to either Port or Starboard side traffic lanes. Secures Cargo for transit after loading is complete	Aft Section of Main Deck
Ground Guide/Deck Hand (88K10)	Directs Cargo to either Port or Starboard side traffic lanes. Secures Cargo for transit after loading is complete	Mid-Section of Main Deck
Ground Guide/Deck Hand (88K10)	Directs Cargo to either Port or Starboard side traffic lanes. Secures Cargo for transit after loading is complete	Forward Section Main Deck

Ground Guide/Deck Hand (88K10)	Directs Cargo to final location on in relation to load plan. Verifies Tie-Down points availability on Deck at cargo location. Secures Cargo for transit after loading is complete	Main Deck

Anti-Terrorist/Force Protection (AT/FP)

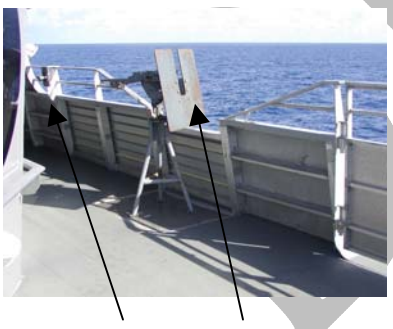
While deployed in the CENTCOM AOR the vessel had to maintain certain AT/FP measures had to be met. Based on port requirements and local Force Protection Condition, which is assessed by Naval Criminal Investigative Services (NCIS). The four levels of Force Protection are Threat Condition Alpha, Bravo, Charlie and Delta. Local commands added to and detracted from each level of Threat Conditions so it was not uncommon to see a Threat Condition Level of Threat Con Bravo (+) plus.

To best protect the vessel, maintain crew integrity and still be a productive logistics platform, the crew was divided into three force protection teams. As a rule, one team was always on duty while the vessel was in port with a second team onboard the vessel on stand-by. This type of force protection was in addition to what was provided by the local Army or Navy Command and the Local Government.

Generally speaking, each time the vessel exited or entered a port; it had an armed floating escort. While the vessel was moored, this floating escort maintained a 100 – 300 yard exclusion zone around the vessel. In conjunction with seaside security and the vessel's force protection team, a landside force protection team was provided. This landside security team was Army Military Police or Naval Security Personnel. Landside security usually consisted of a barrier with controlled pedestrian and vehicular access to the pier. On one occasion, a Marine Corps FAST Team provided landside security.

Vessel self defense consisted of 4 ea mounted (M2) .50 cal machine guns, 4ea mounted M60 7.62 mm machine guns, a roving patrol with a SAW, a quarterdeck watch with a 12 gauge shotgun and an Officer of the Deck with a 9mm pistol. All crew members were qualified on all weapons. In addition to this, each member of the crew had an assigned weapon, 9mm pistol for officers and M16A2 for enlisted.

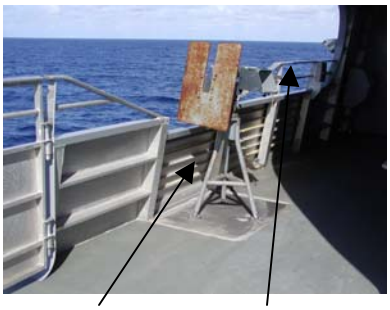
WEAPON MOUNTS



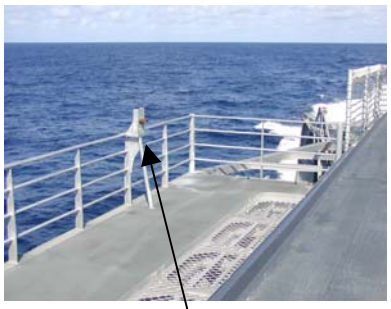
M60 .50 Cal
PORT SIDE FORWARD

M60
PORT SIDE AFT HELO-DECK

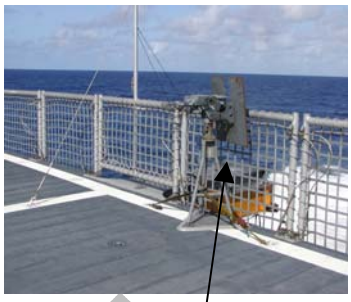
.50 Cal
PORT SIDE AFT LINE LINE HANDLING STATION



.50 Cal M60
STARBOARD SIDE FORWARD



M60
STARBOARD SIDE AFT HELO-DECK



.50 Cal
CENTER LINE HELO-DECK AFT

VESSEL MANNING

Vessel manning could not be fully evaluated due to the mixture of Army and Navy personnel. It is anticipated that the future Theater Support Vessel crew will comprise 31 positions. They are as follows:

Grade	Position
CW4 (880A2)	Vessel Master
CW3 (880A2)	First Mate
CW2 (880A1)	Second Mate
WO1 (880A1)	Third Mate
CW4 (881A2)	Chief Engineer
CW3 (881A2)	First Assistant Engineer
CW2 (881A1)	Second Assistant Engineer
WO1 (881A1)	Third Assistant Engineer
88K40	Detachment Sergeant
88K30	Boatswain
(2) 88K20	Watercraft Operator
(6) 88K10	Seaman
88L40	Bull Oiler
88L30	Junior Marine Engineer
(2) 88L20	Senior Engineman
(4) 88L10	Engineman
92G30	Food Service NCO
92G10	Food Service
	Emergency Treatment NCO
	Radio Operator
	Radio Operator

LESSONS LEARNED TO DATE

ENGINEERING

HEATING, VENTILATION, AIR CONDITIONING (HVAC)

System: HVAC system
Problem: There is no ventilation in the Ante Rooms. These spaces contain the air compressors that generate a lot of heat. This in turn keeps the ambient temperature in this space close to the maximum allowed for proper operation of the DC cabinet. Doors to the space cannot be opened for fear of salt mist migration into the space, thus causing problems with the Switchboards and other electrical equipment.
Recommendation: Installation of a ventilation system in the Ante Room.

System: HVAC system
Problem: During rough weather, the condensate drips out of the units.
Recommendation: Install larger drains and deeper trays in the units.

System: Engineering/Engine Room
Problem: Experiencing high ambient air temps in engine rooms from radiant heat from hull and operating area.
Recommendation: Provide a forced air supply to the Engine Room

System: Engineering/Jet Rooms
Problem: All ventilation in the Jet Rooms is natural convection. This creates a very hot and stagnant work environment.
Recommendation: Provide positive exhaust fans

System: HVAC
Problem: Due to the conversion of the vessel, HVAC controls are in odd places and do not give the flexibility to proper control the environment in various spaces.
Recommendation: Better environmental temperature controls in sections

System: Sliding Doors
Problem: The sliding doors do not seal well. The forward doors in heavy seas do not keep sea spray and water from migrating into the interior. In extreme weather climates (Norway and Persian Gulf), the doors allow the cold or hot air in creating an extra load on the HVAC system.
Recommendation: Replace sliding doors with regular hatches or doors with a sealing surface.

System: Hull
Problem: The Electronics room below the bridge is susceptible to high ambient temperatures due to the exposure of the exterior bulkheads to direct effect of the sun.
Recommendation: Install an air conditioner in the space to keep internal ambient temperatures with in tolerances.

System: Engineering/Ventilation
Problem: Ventilation for the Engine Rooms is natural supply and forced exhaust. This creates very a very hot operating environment in the Engine Rooms.
Recommendation: Install a forced Supply and Exhaust system in the engine rooms with both systems vented to the vehicle/cargo deck.

System: Hull
Problem: There is insufficient insulation on the hull to help control heat loss or heat gain in extreme climates.
Recommendation: Increase the amount of insulation during building to help regulate heat loads.

REFRIGERATION:

System: Refrigeration
Problem: Refrigeration condensers and compressors are located on the mezzanine deck. There are single compressors running multiple units. To do effective troubleshooting this takes 2 people one at the unit in the galley and another on the Mezzanine deck. This also creates an increased requirement for the amount of refrigerant that must be stored onboard.
Recommendation: On future vessels, consideration should be given to purchasing refrigeration and freezers that are self-contained (compressor, condenser) are all in the same unit.

System: Refrigeration
Problem: When the vessel was outfitted, it did not contain a complete refrigeration repair tool kit. The vessel has to procure additional tools that are refrigeration system specific, i.e. vacuum pump, gauges etc.
Recommendation: When outfitting the next vessel, a complete refridgeration tool kit should be included to include a recovery machine.

FUEL SYSTEM

System: Fuel Transfer System:
Problem: The fuel transfer pump in the port engine room is in a difficult position to easily replace. It took 10 man-hours to replace.
Recommendation: Reconfigure the fuel transfer manifold to facilitate easier removal of the transfer pump.

System: Fuel Transfer System
Problem: With the large quantities of fuel the vessel consumes and with multiple sources of fuel is can create problems if a low quality fuel is received.
Recommendation: Placing some sort of fuel purifying system in the system. Whether is be a bank of coalescing filters or a centrifugal purifier

System: Fuel System
Problem: Inaccurate sounding tables in the stability book and ship's drawings. The long range tanks have a sounding plate approximately 300mm from the bottom of the tank the is not accounted for in the sounding charts. This makes accurate soundings difficult and long range operations difficult to plan for.
Recommendation: Ensure that all the fuel tanks are done the same with accurate sounding charts. This is most important when doing fast fueling operations. This vessel has the capability of receiving large quantities of fuel in a short time. Soundings must be accurate by depth, volume and weight in order to operate the vessel at its full potential.

System: Fuel System
Problem: Because this vessel and typical Army vessels visit a wide variety of ports, finding compatible fuel connections is always a challenge. In some cases, the fuel riser had to be removed and a different rider attached.
Recommendation: When outfitting the next vessel, a wide variety of fuel connection adapters should be purchased.

System: Fuel System
Problem: The location of the fuel riser on the starboard side of the vessel is actually in the ramp area. If the vessel is trying to load cargo then it cannot fuel and vice versa. Even though there is a fueling station on the port side of the vessel, this was not used due to the fact that either hose lengths were too short or there was inadequate outboard tie down points to properly moor a barge or vessel outboard.
Recommendation: There are two ideas on how to solve this problem. First being, move the fueling station forward to mid-ships and providing an access door/hatch to the outside of the vessel. This would allow fueling operations to continue without interrupting cargo operations. The other is to move the fuel riser to a different location but in the same vicinity that will not interfere with cargo operations.

STEERING

System: Steering/Trim Tabs
Problem: The hoses on the PTO pumps have failed on 3 occasions, all three occurring on the port side. The same 90 degree fitting has failed in three different places. The second failed 10 hours after installation. None of the hoses were "banded" with test date and test pressure. It also made it difficult because there is no hydraulic oil storage tank that would allow for the replenishment of the system after repair
Recommendation: Additional cameras need to be placed in the jet rooms to allow for monitoring of these hoses. Add a Hydraulic Oil storage tank and test and band all hydraulic hoses.

System: Engineering/Ride Control
Problem: There is no way to physically isolate the trim tab hydraulic ram from the system.
Recommendation: Install positive shut off ball valves on all the trim tabs.

System: Engineering/Steering
Problem: When troubleshooting the LIPS control system, it takes multiple personnel to trouble shoot the system because of the location of the gauges which indicate the status of the nozzles and buckets.
Recommendation: There should be remote LIPS gages (steering, bucket, throttles) at LIPS relay panel in the ship's electronic room.

System: Engineering/Steering
Problem:
Recommendation: steering pump "AUTO", on drop of pressure, not just maneuvering station

COMPRESSED AIR

System: Compressed Air
Problem: Compressors are undersized to adequately support Main Engine starting and support all pneumatic tools and pumps that are used. This leads to the compressors constantly running.
Recommendation: Upgrade air compressors to a larger CFM rating. Increase the number and location of air supply locations throughout the vessel. On the main deck, they should also be no further than 50 feet apart.

SEWAGE

System: Sewage System Overboard Discharge Valve
Problem: One person has to climb up to the valve and use a wrench to open or close the valve. The valve is located at the top of void #5 and there is no platform to stand on. The same is for the macerator inlet valve. When entering the space it takes two people because this is classified as a confined space.
Recommendation: Install reach rods on these valves which are accessible from the vehicle deck.

System: Sewage System
Problem: No monitor to check level on sewage tank.
Recommendation: Install Tank Level Indicator so system can be remotely monitored. Preferably in the ISIS.

System: Sewage System
Problem: Sewage Overboard Discharge Valve construction
Recommendation: Ensure next valve installed is solid bronze or stainless steel inside and out.

System: Sewage System Urinal Trough
Problem: During rough seas flushing water has a tendency to slosh out of the trough.
Recommendation: The front edge of the urinal is rolled out to give a soft edge. Recommend the front edge be rolled in to help keep the water from sloshing out.

POTABLE WATER

System: Reverse Osmosis Water Maker
Problem: Due to the way the unit is installed, the system, at times, requires two people to trouble shoot. One soldier being at the unit itself and the other being in the void, each with a radio.
Recommendation: Place the Reverse Osmosis unit in the void on a platform.

System: Engineering/Potable Water System
Problem: Pumps and pressure tanks are undersized for the amount of embarked crew that lives onboard.
Recommendation: Increase pump size and install larger pressure tanks.

System: Engineering/Potable Water
Problem: No capability to properly sanitize potable water that is produced by the water maker or that is received from a shore facility. There is also no way of monitoring water usage or production.
Recommendation: Add an ultraviolet sanitizer to the water maker or a brominating system with a water test station. There also needs to be a meter placed on the outlet side of the potable water system to measure daily consumption.

System: Hull/Outfitting
Problem: There is no access to water for drinking on the Main Deck or in the ante rooms. The crew had to fill an ice chest full of bottled water and ice and place on the main deck during quarterdeck watches and cargo operations during high heat operations.
Recommendation: Place water fountains in the ante rooms.

System: Engineering/Potable Water
Problem: The showers and faucets on the vessels are not designed for low water consumption rates.
Recommendation: The installation of low LPM (liter per minute) shower and faucets

Integrated Ships Information System (ISIS)

System: ISIS
Problem: Because the vessel remains running 24 hours a day, an in port watch is set at night. This watch is usually the quarterdeck stationed at the gangway. When an alarm on ISIS goes off, there is no one on the bridge to silence/answer the alarm.
Solution: Place a remote monitor for ISIS in the ante rooms with an alarm acknowledgment button.

System: ISIS
Problem: There are certain systems on the vessel that are not included in ISIS.
Recommendation: Ramp hydraulics, Fresh water and Sewage levels should be added.

System: ISIS
Problem: There are no remote indicators on the bridge for the fuel transfer pumps, sewage discharge pump therefore the watch officer is unaware of any pumps are running. There is no ability to start, stop, open or close any fuel valves for fuel transfer from the bridge.
Recommendation: Place remote start/stop buttons for these systems on the bridge with motor run indicators and remote operation of the valves with valve open/closed indicators.

System: Engineering/ISIS
Problem: The ISIS system sensors give false readings and must have someone physically go into the Engine Room and verify questionable readings with a hand held Infra red thermometer
Recommendation: Install dual temperature sending units on engines (critical systems)

System: Engineering/ISIS
Problem: When having to replace some sensors, system integrity has to be compromised. In the cooling water system, in order to change some sensors, engine coolant has to be drained.

Recommendation: Dry wells for all sending units
System: Engineering/ISIS
Problem: When a alarm sensor goes bad, it is difficult to locate the sensor on a particular piece of equipment.
Recommendation: All ISIS gages labeled and documented by location both in print and graphically (picture)

System: Engineering/ISIS
Problem: When trouble shooting or verifying an alarm in ISIS it is prudent to review the sensor/alarm history. To do this, the Engineer has to exit out of one screen and toggle through numerous screens before finding and locating this data.
Recommendation: A "double click" on the ISIS panel gives history, set points, type and trends graphically

System: Engineering/ISIS
Recommendation: A more detailed display of power generation functions should be included in ISIS along with detailed generator kw/hz/volts recording and management in ISIS

System: Welding/Hull
Problem: When welding is to be accomplished onboard the vessel, ISIS needs to be completely secured. This means that there are no electronic sensors working on the vessel and no equipment being monitored. Removing all J-Plugs every time will cause them to fail prematurely because of broken wires causing multiple alarm failures.
Recommendation: Place more analog gauges on equipment so that it may be monitored while ISIS is offline and centralized disconnects for the ISIS system that will allow for isolation of the J Plugs without having to disconnect them from the ALU.

System: Engineering/ISIS
Problem: When trouble shooting the ISIS system, system cables on different runs are labeled differently (3-5 different wiring harness numbers) making it difficult to trace a particular wire completely through the system.
Recommendation: Continuity of ISIS channel numbers throughout the wiring harness from sensor to monitor.

ELECTRICAL

System: Engineering/Electrical
Problem: Experiencing high temperatures in the DC cabinet in the Ante Rooms
Recommendation: Install extra fans in the cabinet

System: Engineering/Electrical
Problem: In order to turn exterior lights on and off, an engineer has to go to numerous panels
Recommendation: Have the ability to control all exterior lights from bridge

System: Engineering/Electrical
Problem: Engine Watch Officer is unaware of the electrical condition of the vessel while underway. This becomes critical during firefighting.
Recommendation: Install at the Engineer Watch Officer Station on critical breakers, DB1 to DB5, open breaker indicators

System: Hull
Problem: The electronics room is exposed to external sources of high radiation from other vessels electronics systems and radar. The vessel was exposed to this during maneuvers with a Naval vessel and suffered electronic losses to the ISIS, steering and communication systems
Recommendation: The electronic systems need to be shielded from high energy systems.

System: Engineering/Electrical
Problem: When there is a power failure or power is secured for fire fighting, there is insufficient lighting on the Main Deck to conduct safe operations.
Recommendation: Increase the amount of emergency lighting in the Main Deck areas.

System: Engineering/Electrical
Problem: Throughout the vessel, there is a wide variety of receptacles and outlets that meet different country standards. This creates a logistic problem for support by having to carry such a wide variety of plugs, extension cords and outlets.
Recommendation: Adopt the European standard for outlets.

System: Engineering/Electrical
Problem: 50/60 Conversion Van is over engineered for the Army's requirement.
Recommendation: Remove the van and install 120VAC 60 hz solid state converters

System: Electrical/Lighting
Problem: Halogen lighting in certain areas of the vessel increase the amount of heat added to the space.
Recommendation: Convert Halogen lighting to fluorescent type lighting.

System: Main Deck
Problem: If refrigerated containerized cargo is going to be carried in the future, there is no means to keep the reefer containers running other than using their pony motors. This would create an excess of exhaust fumes on the main deck.
Solution: Consideration should be given on the next vessel to providing at least 10 outlets with pigtails of sufficient size to run the reefer containers off of ships power

REDUCTION GEARS

System: Engineering/Reduction Gears
Problem: There have been numerous PTO flexible coupling failures. This has resulted in one PTO having to carry the load of the whole hydraulic system while underway.
Recommendation: Have PTOs installed on each reduction gear to provide the necessary redundancy for the ships hydraulic systems.

CLOSED CIRCUIT TELEVISION

System: Close Circuit Television
Problem: Great system that can be utilized for more than docking undocking and surveillance of the vehicle deck. This is an effective security tool.
Recommendation: Allow access to the system with split/quad screens from other areas on the vessel such as the quarter deck

System: Engineering/Closed Circuit TV
Problem: When engineers enter engineering spaces, the Engineer Watch Officer cannot observe everything that is happening in that space because the cameras are fixed. Engineer Watch Officer is also limited in his ability to properly monitor the space when it is unmanned, this creates a safety hazard.
Recommendation: Engine room and deck CCTV's should have the ability pan, tilt and zoom allowing for greater coverage of the spaces.

GENERAL

System: Ships Drawings
Problem: With all of the fire boundary panels, it is difficult to know what is behind the panels when troubleshooting systems.
Recommendation: Digitized photo gallery of the boat "as built" that corresponds directly with the drawings. This will enable the engineers to see what is behind fire panels with out having to take them off to troubleshoot or find electrical or mechanical connections.

System: General
Problem: Due to the depth of the bilges and voids a pump that has the ability to pump with approximately 50' of head pressure is needed.
Recommendation: When outfitting future vessels, consideration should be given to purchasing a pump which is big enough to satisfy this requirement while not exceeding the output of the vessel's compressed air system.

System: Hull
Problem: Currently many operations take place in the void spaces. In order to meet Army and Code of Federal Regulation requirements for confined spaces, there is a need to ventilate and test these spaces every time they are entered.
Recommendation: Suggest that a connection for a ventilation hose be placed next to the entrance of each space making it with a water tight seal to fit while at sea. This would allow portable ventilation of the space, using the entrance for the exhaust and speed up the qualification and entry time making it a safe work environment.

System: Engineering
Problem: Because this vessel is deployed away from its home station and many repairs are performed onboard, there is little space for proper work stations. One was assembled on the Main Deck. This proved to be sufficient but not ideal. The Engineers were exposed to the elements at all times. These conditions varied from sub-freezing Artic cold to the high heat reaching into the mid 120F degree range in the Persian Gulf.
Recommendation: Provide a workshop space for performing repairs on board that is protected from the environmental elements.

System: Hull/Outfitting
Problem:
Recommendation: Identify all onboard spare parts by nomenclature, part number in the repair/manufactures manual and location

System: Fire fighting
Problem: There is an insufficient amount of fire fighter ensembles to properly outfit a complete fire teams. This includes spare Self Contained Breathing Apparatus (SCBA). Enough extra bottles should be included to fight a fire longer than 2 hours. The novice firefighter consumes a SCBA bottle in approximately 5-7 minutes. Experienced firefighters, through extensive training and exposure to fires on a regular basis can make a bottle up to 20 minutes. No consideration has been given to the adrenaline rush and anticipation of entering a live fire.
Recommendation: Increase the amount of fire fighting ensembles onboard to outfit 50% of the crew.. Carry an increased number of SCBA bottles to no less than 2 bottles per ensemble and install the appropriate air compressor for refilling the bottles.

System: Fire Alarm System/Panel
Problem**:** The heat sensors under the helo deck and under ramps A&B keep alarming. Smoke detectors in the enlisted and officer quarters keep going into the alarm mode.
Recommendation: Move the heat sensors away from the under side of the helo deck allowing for improved air circulation and further from the radiant head on the underside of the deck. In the enlisted and officers quarters, the alarms are being set off by excessive moisture from the A/C evaporator units. Recommend moving the sensors further away from the A/C units.

System: Engineering/Hull
Problem: In heavy seas and shallow water the sea chests have the tendency to become congested with foreign debris, i.e. jelly fish, mud etc and engines must be secured to clean the simplex strainers
Recommendation: redundant sea chests /duplex strainers which will allow the vessel to continue operations without having to secure engines to clean this system

DECK OPERATIONS

CARGO OPERATIONS

System: Stern Ramp
Problem: When maneuvering in port, the stern ramp cannot be raised or lowered. The hydraulics for steering have priority. This makes it difficult to prepare the vessel for mooring.
Recommendation: Install a separate Hydraulic Power Pack to support the stern ramp as a stand alone system.

System: Stern Ramp
Problem: All greasing of cable has to be done by hand. This is an inefficient way to grease cables. The cables do not get properly cleaned and the grease is applied only on the outside of the cable.
Recommendation: When outfitting future vessels, a wire rope pressurized greaser should be purchases. This will ensure the cables get properly cleaned and that a sufficient amount of grease is force into the core.

System: Stern Ramp
Problem: When the stern ramp gets wet, the surface becomes slick and the traction bars do not provide the necessary traction for vehicles to transit the ramp.
Recommendation: Adopt a “herring bone” pattern for traction bars on the ramp that stand proud enough from the deck to facilitate better traction in wet conditions

COMMUNICATIONS

System: Communications
Problem: The talk back system for the engineers in the engine spaces does not allow for sufficient freedom of movement while in the space.
Solution: When out fitting future vessels, hands free radio head sets that meet the hearing protection requirement should be purchased. This will allow the engineer to move freely about the space and still remain in contact with the bridge.

System: Communications
Problem: There is no rapid means of communications between the Chief Engineer when he is off duty and the Engineering watch. There is also no way for the Chief Engineer to monitor what is happening without having to go to the bridge.
Solution: When constructing future vessels, consideration should be given to placing an ISIS monitor in the Chief Engineers quarters along with a "bat phone" that rings directly at the Engineering Officers station on the bridge. The Vessel Master should also have a slave monitor of the ships charting system in his quarters.

System: Communication/Navigation
Observation: The Integrated Navigational Awareness System (INSA) was already in service installed on a laptop computer; this system was upgraded to a desk top computer to improve response time. It is fully functional.

System: Communication/Navigation
Problem: During this period the vessel has had numerous difficulties in maintaining SIPRNET and NIPRNET connectivity. This is due to the inadequate footprint of the Ku Band satellite. The way the vessel communication system was designed routes all of the critical communications through this satellite. This also includes the Global Command and Control System – Maritime (GCCS-M). This has eliminated any sort of redundancy in communication and greatly reduced combat effectiveness.
Recommendation: The system must be re-engineered to allow for an alternate means of secure communication with the rest of the services.

System: Communication/Navigation
Observation: The Gate Guard system allows the vessel to send and receive Defense Message System (DMS) traffic. It allows the vessel to send and receive classified message traffic. This type of traffic includes Diplomatic Clearances, Anti-Terrorist/Force Protection Plans, Logistic Requests (LOGREQ), and position reports using the STU-III phone via the International Maritime Satellite (INMARSAT) Mini-M. This system should be installed on all Army Class A-2 watercraft.

System: Communication/Navigation
Observation: The navigation programs TRANSAS and C-MAP are comparable in service. Through active comparison the crew generally found that TRANSAS to be the better system for the user. Some specific features that should be added to C-MAP are: Distance to Go, and a visual log with times of passage along the track line.

System: Communication/Navigation
Observation: The 40 RPM high-speed radars are easy to use and correctly positioned in their current configuration.
Recommendation: To eliminate the resonance of the High Speed Radar scanner through the top of the wheel house, recommend installing a mast aft of the wheel house and installing both scanners and additional antennas on the mast.

System: Communication/Navigation (Army C4I package)
Observation: This system was installed with minimal problems. The system provides secure transfer of both voice and data using VHF, HF and UHF/High Sat Com. It was tested in all modes and is fully functional. Other issues during install were acquiring the appropriate cryptographic fills.

System: Communication/Navigation
Observation: The INMARSAT Mini-M has been the most dependable piece of communications gear on the vessel.

System: Communication/Navigation
Observation: The Standard Automated Logistics Tool Kit (SALTS) was used to provide e-mail service as well as a number of other services to support the vessel while deployed. It is fully functional and has been the bridge in communications since the failure of the Ku Band.

System: Communication
Problem: To page someone to the Quarterdeck, the quarterdeck watch has to radio to the Officer of the Deck or the other quarterdeck watch to make a shipboard announcement.
Recommendation: Have a phone installed in the general area of the quarterdeck that has access to the ships Public Address system.

System: Communication/Navigation
Observation: The electronic charting system should have the capability to be over laid onto the radar screens, for true integrated bridge operations.

System: General Announcement/TV system
Problem: Due to the conversion of the vessel, controls for the ships PA and entertainment system cannot be properly controlled. If the volume is turned down in the C4I Space, then an announcement cannot be heard in the planning space.
Recommendation: Sectionalize P.A. and T.V. speakers

System: Hull
Problem: The telephone system on the vessel is insufficient to handle all of the day to day traffic that is accompanied with running a vessel while in port.
Recommendation: The addition of a 7 telephone exchange throughout vessel to include the Quarterdeck would better support the vessel's needs.

GALLEY

System: Galley
Problem: The deck in the Galley is not set up to handle the wear and tear of a normal shipboard galley.
Solution: When constructing future vessels, consideration should be given to changing the deck covering to a non slip surface. There should also be over sized drain lines in the deck to handle washing and sanitizing of the deck.

System: Galley
Problem: Sink is too small to handle large pots and pans
Recommendation: Upgrade sink so that it is large enough to handle pots pans and cooking sheets.

System: Hull/Outfitting
Problem: Galley was not outfitted to properly support a regular ship's compliment
Solution: Understanding that this is a demonstration vessel, future vessels should be outfitted with the necessary galley equipment to support the ship's crew. Include larger storage facilities for dry goods, refrigerated and frozen goods and equipment storage.

TRAINING

System: Welding/Training
Problem: There are no certified welders for aluminum onboard the vessel. This leaves the crew unable to perform emergency repairs while deployed.
Recommendation: Add a Det Norske Veritas certified welding phase to the Engineering Officer and to the Enlisted Engineer BNCOC and ANCOC courses.

System: Training/Manning
Observation: All crew should attend the Safety Systems Course in accordance with the International Maritime Organizations High Speed Craft Code, Chapter 18.3.
Recommendation: This training should be developed for military personnel (Army, Navy, and Coast Guard) by type rated Army crew and approved through the appropriate agencies.

System: Training/Manning
Observation: Training for Bridge Watch standers should include the following:
Basic Computer Literacy Course, three day hands on Electronic Charting Course, High Speed Navigation Course (including ARPA and High Speed Radar Techniques) and then incorporate all of these into an extensive Bridge Simulator Course.

VESSEL OPERATIONS

System: Bridge
Problem: The bridge is too small for operations. Some of the problems encountered are too much ambient light for the Engineer's console and monitors encumbering the Deck Officer and Navigator night vision. There is inadequate room for the additional communications gear to be stored. Not enough counter top space to do navigation chart work.
Recommend: Enlarging the bridge and moving the engineer's station behind and below the Navigation crew. This would eliminate the ambient light problem and also being placed lower than the Navigation team will not block their view over the stern of the vessel.

System: Line Handling Stations
Problem: No cleats on bulwark to hang additional fendering. Since the Army visits a number of ports, there are a variety of fendering systems that are encountered. Some times the fenders catch on the rub rail or on the stern jet guard or the fendering is not spaced properly to accommodate the HSV.
Recommendation: Recommend putting in place a system that will allow additional fendering to be hung over the sides of the aft mooring stations.

System: Hull/Outfitting
Problem: The mooring lines for the vessel are strong, light and easy to handle but do not meet the needs of the vessel in all situations. The lines offer no stretch which has caused mooring problems when there is a sea surge. This is also evident when using the capstans. The lines do not grip the capstan causing the lines to slip.
Recommendation: Thought should be given to purchasing different lines for the vessel.

System: Hull/Outfitting
Problem: There have been failures in the bits and cleats on the vessel mooring stations. Crushed capstans and broken H-bits have created hazardous working conditions at the mooring stations.
Recommendation: Install more rugged H-bits and capstans.

System: Hull/Outfitting
Problem: Insufficient control of light management on the bridge.
Recommendation: A better lighting control plan should be adopted for the bridge and interior of the vessel. Incorporation of red light discipline and more localized control should be considered.

System: Hull/Outfitting
Problem: Searchlight does not provide versatility to properly support navigation in limited visibility.
Recommendation: For night time navigation, a Forward Looking Infrared camera should be installed with the monitor on the bridge. This would be a great night time navigation aid.

System: Hull/Outfitting
Problem: Bridge chairs do not provide enough support or adjustability to support a wide variety of bodies or sailing conditions
Recommendation: Upgrade the chairs on the bridge to a more adjustable chair that fits a larger variety in height of people and that provides sufficient support during rough seas.

System: Hull
Problem: Due to the mission of the vessel, it visits a variety of ports throughout the world. Along with this comes a wide variety of piers and fendering systems. There have been instances where the rub rail is insufficient to provide the proper pier to vessel stand off. Often times, the rub rail gets caught underneath the existing pier fendering or the pier itself.
Recommendation: Add vertical rub rails in addition to the exiting horizontal rub rail.

System: Hull/Outfitting
Problem: Lack of storage for repair parts, office supplies, cleaning supplies
Recommendation: On future vessels, this should be included in the initial design.

System: Hull/Outfitting
Problem: Control for the aft line handling station windlasses are on the deck above. This means at least 2 people are required at the mooring stations during docking and ship movements.
Recommendation: Move the controls for the windlasses to the mooring stations.

System: Hull
Problem: The vessel in rough seas has lost/damaged the doors on the aft line handling stations. This is due to lightweight construction that is not durable enough for open ocean transits.
Recommendation: Install thicker or doubler plates at pilot station / door

System: Hull
Problem: Deck covering in the Ante Rooms and on ladders/stairs when wet is slippery.
Recommendation: Textured deck in stairs and ante room decks

System: Hull/Outfitting
Problem: During Man overboard drills in the open ocean the rescue boat is not large enough or robust enough to handle more than 3 people.
Recommendation: During future vessel outfitting, consideration should be given to placing a work boat similar to that of an LSV or 128' Tug. This will meet the robustness requirements and also provide easier logistical support through the military supply system.

GENERAL

System: General
Problem: Due to the fact that there is not painting required on this vessel, keeping the vessel salt free and dirt, especially in the Persian Gulf, is a high priority. There is insufficient fresh water supply on the vessel to aid in this task, therefore the salt and dirt build up quickly.
Solution: When outfitting the next vessel, consideration should be given to purchase at least two pressure washers (diesel or electric) that have sufficient pressure to clean and yet do not exceed 5 or 6 gallons per minute in water consumption.

System: Storage for ship's gear
Problem: There is insufficient space for the storage of extra ship's gear. Currently, the vessel crew are using framing members to store/hang equipment on. Fenders, tie downs, cleaning supplies, extra line, pressure washers etc.
Recommendation: In the "horseshoe" area of the forward ramps, there is space that is not utilized for rolling cargo due to vessel design. Recommend using some of the is space for shelving and storage.

System: General
Problem: There are not enough secure safes on board the vessel.
Recommendation: Safes for voyage funds, Credit Cards, Subsistence Funds should be located in the following areas: Vessel Masters and Chief Engineers office and the ship's office.

System: Hull/Outfitting
Problem: During rough seas a crewmember has no means to steady themselves while in the shower or in the head.
Recommendation: Installation of grab rails in the showers and heads.

System: Hull/Outfitting
Problem: The outfitting of this vessel is great. However, for ease of maintenance and cleaning the passenger area with its carpet creates a cleaning problem. Wet, dirty boots leave marks in the carpet, which increases cleaning time.
Recommendation: In the passenger section of the vessel, keep the deck outfitted with easy to clean deck coverings.